National Institutes of Health
National Center for Research Resources

National Meeting on *Enhancing the Discipline of Clinical and Translational Sciences*

Executive Summary

Doubletree Crystal City National Airport Hotel
Arlington, VA

May 23, 2005

An archived Webcast of the meeting, meeting materials, and community feedback

are available at the NCRR Web site at: www.ncrr.nih.gov/clinicaldiscipline.asp

Welcome and Overview

Dr. Barbara Alving, Acting Director, National Center for Research Resources (NCRR)

Dr. Barbara Alving opened the national meeting on "Enhancing the Discipline of Clinical and Translational Sciences" by welcoming attendees and thanking them for their participation. She then introduced Dr. Elias Zerhouni, director of the National Institutes of Health (NIH), who was asked to describe his vision for enhancing the discipline of clinical and translational sciences.

A Strong Foundation: Building a Home for Clinical and Translational Sciences

Dr. Elias Zerhouni, Director, NIH

Dr. Zerhouni noted that, soon after he was appointed as NIH director, he launched the NIH Roadmap for Medical Research, which provides a strategic framework for cross-cutting initiatives that apply to all of NIH. An important component of the NIH Roadmap is the effort to re-engineer the clinical research enterprise. Initially, this effort was to be accomplished through six initiatives designed to enhance clinical research networks and informatics, workforce training, translational research, and other aspects of the clinical research enterprise. However, Dr. Zerhouni noted, the leadership at NIH came to realize that a critical "fusion event" was needed to truly transform the clinical research enterprise.

Over the past decade, NIH has provided considerable support to clinical and translational sciences in various forms. NIH-funded clinical research training programs, the General

Clinical Research Centers (GCRCs), and disease-oriented clinical research centers are important components of the research infrastructure in the Nation's academic health centers. But the question today, Dr. Zerhouni said, is whether these components are as effective as they might be. He proposed that several "missing pieces" could be put in place to create a less fragmentary, more systems-based approach to strengthening clinical and translational sciences. These missing pieces might include upgraded biostatistics and informatics, degree-granting components, and translational cores, but also other innovative elements or programs that are needed by the institutions.

The challenge today, Dr. Zerhouni suggested, is to determine if an academic and intellectual home is needed for clinical and translational sciences. The NIH Roadmap provides the "bricks," but does not build a home. He proposed that this academic home include a cadre of well-trained investigators and integrated resources that will advance the new intellectual discipline of clinical and translational sciences. The new home will advance the health of the Nation by transforming patient observations and basic discovery into clinical practice.

Dr. Zerhouni suggested that the time has come to break down the programmatic and disciplinary "silos" and create new bridges across scientific fields, stimulating change at all levels. Creating a strong foundation for clinical and translational sciences will require flexible programs, tailored to the needs and strengths of individual institutions.

Dr. Zerhouni asked for input from the research community. He asked meeting participants to be bold and think of innovative models. He expressed confidence that this new, comprehensive view of enhancing clinical and translational sciences will lead to greater flexibility, with integrated resources that will serve science and scientists more effectively.

Dr. Zerhouni thanked Dr. Barbara Alving for her leadership and willingness to take on this new effort, and he introduced Dr. Robert Star, who took the lead in organizing this national meeting.

Charge to Attendees

Dr. Robert Star, Senior Advisor on Clinical and Translational Sciences, NCRR

Dr. Star reiterated that meeting participants are being asked to provide input on re-engineering current approaches to conducting clinical and translational science. The goal is to create a system that is more flexible than NIH has provided in the past, to break down programmatic and disciplinary "silos," and move toward the systems biology approach described by Dr. Zerhouni.

Dr. Star noted that there would be five breakout sessions, listed and briefly described below.

- *Session 1: Components of a Clinical and Translational Sciences Academic Home.* Participants were asked to identify desirable components of an academic home

and consider how to prioritize these components, govern them, and fit them together.

- *Session 2: Institutional Culture and Commitment for Clinical and Translational Science.* Discussants were asked to consider: How do you get institutions to change, and how do you sustain this change? What institutional issues must be addressed to enable changes in mission, space allocation, finances, promotion, tenure, and educational pathways?
- *Session 3: Education, Training, and Career Development.* This group was asked to imagine a more efficient and effective education, training, and career-development pathway for the clinical and translational sciences. This pathway should be designed not only for principal investigators, but also for all members of multidisciplinary teams.
- *Session 4: Clinical Research Informatics.* Participants were asked to identify areas where informatics would be most helpful, and to consider what type of institutional or national leadership would be needed to take full advantage of informatics in the clinical and translational sciences.
- *Session 5: Intra- and Inter-Institutional Collaboration.* This group was asked to consider how sites might work together to develop the tools and training programs needed for clinical and translational sciences, and then to share and distribute their findings to a wider community. How would the discipline of clinical and translational sciences be enhanced by collaboration at institutional, regional, and national levels?

Breakout session participants were asked to consider the critical issues that they face, identify barriers to success, and move quickly to possible solutions and strategies for implementation.

During the last session of this national meeting, Dr. Star explained, the entire assembly would reconvene to hear 10-minute summaries from each of the five breakout groups, followed by a general discussion. He added that the meeting was being Webcast, that the Webcast and other meeting information (agenda, slides, summaries) would be accessible via the NCRR Web site (www.ncrr.nih.gov/clinicaldiscipline.asp), and that there would be later opportunities for the community to provide additional feedback via that Web page.

Breakout Session 1

Components of a Clinical and Translational Sciences Academic Home

Participants in this breakout session expressed enthusiastic support for NIH Director Dr. Elias Zerhouni's initiative to enhance the Nation's capacity for conducting clinical and translational research. To create an academic home for this new multidisciplinary field, a sufficient and durable commitment of resources must be made, and the commitment must last over some period of time. Discussants agreed that the new investments for clinical and translational sciences should be merit based and broad based, touching many institutions.

The question of terminology was discussed at some length, specifically, how clinical and translational research should be defined. Possibilities ranged from broad definitions such as those previously used by NIH and by the Association of American Medical Colleges, or any research requiring an institutional review board (IRB), to a more narrow definition that would include only research involving living human patients. The group also discussed whether to extend the definition of clinical and translational research to include research in populations as a whole and studies of animals. No resolution was reached on these questions, although there seemed to be general agreement that live humans were at the center of the spectrum.

The group agreed that an academic home for clinical and translational sciences must be backed by a firm institutional commitment and capacity to implement high-quality research.

The organizational structure of the academic home was debated at some length. The general consensus was that flexibility is critical. Each institution must be free to fashion its new academic home in a way that makes sense within its existing organizational structure.

The group discussed several possible structural and content components of an academic home for clinical and translational research and issued the following recommendations:

- Institutions might establish a central unit whose exclusive purpose is to address all the issues and identify all the resources needed to conduct clinical and translational research. The purview of such an entity might include oversight of regulatory matters, IRBs, financial commitments, and the incorporation of other important core structures, such as a GCRC. It should serve as a hub for clinical research within an institution/region.
- Existing institutes, centers, or departments within an institution might be integrated or transformed to create an academic home. Some discussants suggested that General Clinical Research Centers (GCRCs) might be transformed or expanded to create centers for clinical and translational research.

- Alternatively, institutions might establish an Office of Clinical and Translational Research to provide central resources and infrastructure to nurture large-scale interdisciplinary science.
- The content—like the organizational structure—of the academic homes should be flexible enough to align with an institution's existing resources, facilities, and needs. Participants generally agreed that a core facility of some sort would be advantageous, although activities within these settings may be diverse and dispersed. Within this core, certain technologies may be needed, such as nuclear magnetic resonance (NMR), positron emission tomography (PET), and tools for genomics and proteomics research. Other potential cores mentioned included information technology, protocol development, recruitment (including recruitment of underrepresented minorities), data management and research staffing.
- The training and post-training environment was identified as critical, with support for early- and mid-career faculty members of particular importance. Individuals who have completed training-grant programs are often set adrift in faculty positions with their attendant, sometimes conflicting pressures. To support these faculty, a vision beyond training is needed and should be accomplished through a meaningful funding mechanism and mentoring by established investigators.
- Leadership is crucial to an academic home and must be cultivated by senior administrators at institutions. To some extent, creating new resources will naturally foster individuals whose professional goals are aligned with this new vision of clinical and translational sciences, allowing them to rise within the institutional hierarchy.

- The group used the metaphor of “glue” to describe strategies for uniting diverse components and providing an academic and cultural home for clinical and translational research. This “glue” might consist of clinical therapeutics as a core that facilitates the conduct of clinical research. Components that must be integrated include those previously mentioned: equipment and technologies, recruitment, data management, staffing (including research coordinators), and space.
- Having a physical location for the academic home will help to create a visible focus on clinical research. Toward this end, support mechanisms may be needed for construction or renovation projects, although discussants recognized that funding for such projects has dwindled in recent years.

Participants also discussed the disconnect between the basic and clinical sciences. Today, few clinical scientists are studying mechanisms of disease, whereas such individuals were once considered the “great investigators” of institutions. Strategies are needed to regenerate mechanistic studies and investigators who are skilled in this area.

Breakout Session 2

Institutional Culture and Commitment for Clinical and Translational Sciences

Participants in this breakout session voiced strong support for the NIH initiative to enhance clinical and translational research. Many institutions have thought deeply about the need for creating an institutional culture that will facilitate such research. Some institutions already have programs in place—or are modifying current programs—to create an academic home for clinical and translational research. Session participants provided several examples of institutions that may serve as models for future efforts.

The group agreed to use NIH Director Dr. Elias Zerhouni's broad definition of clinical and translational sciences throughout their discussions. This definition includes research ranging from laboratory studies in which a potential disease application is first recognized to disease-oriented and patient-oriented research, clinical trials, epidemiology, and prevention.

Because academic medical centers and universities vary so greatly in size, structure, and focus, no one specific model will be appropriate for all institutions. Clearly, "one size does not fit all" when developing institutional models for clinical and translational sciences.

The breakout group identified five main areas that must be considered when creating a new institutional model for clinical and translational research. These areas include:

- *What are markers of success?* Participants identified several characteristics that might indicate the success of an institutional model. These include research that ultimately changes clinical care, the appointment and promotion of clinical and translational researchers, recognition and respect for faculty in the clinical and translational sciences, sufficient funding to allow time for research, and instances of collaboration that foster interdisciplinary research;
- *What model or structure?* Participants agreed that there should be a "home" for clinical and translational sciences. The home might be based within a department; within an institute, center, or program; or with an academic institutional officer, such as a dean for clinical research who oversees and coordinates all components. Breakout group members expressed preference for the second and third options, in part because a departmental structure might create a disciplinary "silo" that would be difficult to integrate and expand within an institution;
- *What issues must the structure address?* The new institutional model must address the appointment and promotion of faculty; encourage interdisciplinary and multidisciplinary research teams, including space for unplanned interactions and forums; ensure established and funded time for research; provide mentoring, career development, training, and education targeted to many stages of professional development; and support the granting of degrees;
- *Who can assist with change?* Because of the interdisciplinary nature of clinical and translational sciences, an academic home for this new field must engage basic

science partners, schools of pharmacy, schools of nursing, and other schools within the academic health center. Ideally, the new home should engage stakeholders through the entire academic community, including schools of engineering, biological sciences, and the humanities. Discussants suggested that leaders from outside of academe—such as the pharmaceutical and biotech industries and health care payers—could provide novel insights into improving organizational structures and promoting clinical and translational research. The program might feature new categories of investigators who work outside the traditional academic structure; and

- *What are the criteria for promotion?* Regarding the promotion of clinical and translational researchers at different institutions, again, "one size does not fit all." The arc of a clinical researcher's career, involving time to publish and co-author, presents complexity as well as variation. Criteria for promotion need to be developed to reflect the team nature of this form of science. Criteria for promotion should be set within the institutions (whether by the medical center itself or by the whole university needs to be determined). The concept of scholarship should not be considered monolithic. A researcher's peers should be part of the evaluation committee.

Breakout Session 3

Education, Training, and Career Development

Discussions in this breakout session focused on transforming the education process in order to effectively attract, train, and retain high-quality clinical and translational researchers. Session participants were divided into four subgroups, each focusing on one of the following key areas: The impact of an academic home for clinical and translational sciences; resources for effective clinical research education; optimal support of effective education; and difficult-to-discuss topics related to clinical research.

The Impact of an Academic Home for Clinical and Translational Sciences

Participants in this subgroup focused their discussion on types of institutions and training models. Participants also discussed the advantages and disadvantages of training clinical research candidates at various stages of their careers and education. These stages include:

- *Independent Scientist.* The advantages of clinical research training at this stage of professional development include access to resources, established identity, robust career path, increased collaboration, efficiency of research, favorable environment for mentoring, and attractive conditions for junior faculty. Disadvantages include transition costs associated with leaving the home institution, under-resourcing, and fragmentation of the current culture;
- *Post-Doc or Clinical Residency.* Primary advantages of clinical research training at this stage include enhanced mentoring opportunities (quality control), targeted

curriculum, economy of scale (didactic, mentoring, access to core disciplines, proximity to bioinformatics), and early exposure to mentors; and

- *Graduate/Undergraduate/High School.* Advantages to launching training at this stage include earlier exposure to the concept of clinical research. However, some participants considered such training to be too early in the pipeline.

Some discussants suggested that intra-institutional collaboration—especially involving General Clinical Research Centers (GCRCs)—would help to facilitate the creation of an academic home for clinical and translational research. However, other participants suggested that this model might weaken traditional departments.

In summary, participants concluded that an academic and intellectual home for the clinical researcher must have the following features:

- The home must enable clinical research and education to occur simultaneously and under the same auspices;
- The home must be multidisciplinary;
- Increased resources must be available for the enhancement of clinical research; and
- The academic home also must be the home of graduate degree-granting programs.

Resources for Effective Clinical Research Education

Discussion within this subgroup included targeting skills earlier in the pipeline and relaxing the constraints between education and center research activities in the GCRC

setting. In general, participants felt there was inadequate NIH funding for investigator-initiated (R01) grants in clinical research, a shortage of mentors, and a lack of institutional support for the clinical research discipline. Furthermore, discussants generally agreed that NIH should revisit rules regarding R01s and devote more money to clinical research educational and training grants, including the Mentored Clinical Scientist Development Program Awards (K12s) and the NIH National Research Service Award: Institutional Research Training Grants (T32s).

In summary, this subgroup proposed the following recommendations for enhancing essential resources:

- Increase NIH funding for educational and training grants, including T32s, K12s, Mentored Patient-Oriented Research Career Development Awards (K23s), and Clinical Research Curriculum Development Awards (K30s);
- Centralize institutional infrastructure for training and career development in clinical research. The K12 program could serve as a model. Include basic science training;
- Increase the pool of mentors through a variety of funding mechanisms, including late-career mentor awards;
- Target potential researchers earlier in their careers so that tuition could be included in medical school costs;
- Extend career development through a variety of funding mechanisms; and
- Allow time for assessing outcomes.

Optimal Support of Effective Education

This subgroup discussed the hypothetical structure of a first-rate training program for clinical research candidates. Participants also addressed the need for a mechanism to stimulate high-quality clinical research questions. Several models for training programs were considered:

- *The college/graduate school model* offers the advantages of adequate student retention, mentoring opportunities, career development counseling, and a continuum of didactic subjects. However, some participants found it unlikely that college or graduate schools would be amenable to students' seeking a clinical research career, and that the college setting would separate the clinical research enterprise from the rest of education.
- *The center/institution setting* offers the advantages of nondisciplinary orientation. The disadvantages include the need for high-level buy-in and the question of tenure in departments and divisions.

The model for clinical research training must be flexible, possibly including a network of centers, and should include training of critical personnel, such as nurse coordinators, thereby creating a community of well-trained clinical research staff.

Novel structures for training were proposed, modeled on existing institutions such as the Harvard Stem Cell Institute and The Scripps Research Institute. Such bodies are wholly dedicated to research, and Scripps in particular was regarded as entirely translational in

concentration. Ideally, such a structure would take time to nurture junior faculty and devote significant dollars to both clinical research and clinical training.

Discussants concluded that the structure for a training pathway in clinical research should be a matrix, such as a center or institute, that includes the following features:

- The center must be truly multidisciplinary;
- The center needs a dedicated space;
- The center should be flexible and well resourced in terms of core disciplines and necessary personnel; and
- The center must have an interface with the community and be well integrated within the academic health center.

In addition, discussants issued the following recommendations:

- A serious commitment must be made to career development, and institutions must commit to developing clinical research as a discipline;
- Individuals must have early and ongoing access to the educational pipeline in clinical research;
- Promotion policies must recognize and respect the clinical research discipline;
- Scalable funding mechanisms are needed to allow participation of smaller institutions; and
- Tailored training is needed, for professions ranging from technical and nursing positions to the community clinician.

Difficult-To-Discuss Topics Related to Clinical Research

This subgroup focused on unacknowledged issues and concerns, as well as suggestions for new paradigms to enhance clinical research. Participants believed that NIH has a tendency to select obvious "winners" when reviewing grant applications, thereby creating a risk-averse environment that naturally hampers creativity and novel directions in research.

Mentors and institutions must make the clinical researcher's niche a welcoming and comfortable place, discussants suggested. To attract talent to clinical research, programs must address the problem of family and career balance. Another pressing issue is that the clinical research field is considered by many to be too difficult, time-consuming, and financially unrewarding. No consensus was reached as to whether shared or part-time positions could be successfully utilized to make this field more attractive to the family-oriented individual.

Recommendations issued by this subgroup include the following:

- Appropriately define clinical research to include patient-centered and hypothesis-driven emphasis;
- Confront the dominance of basic research at NIH;
- Reduce the regulatory burden while protecting human subjects in clinical trials;
- Restructure NIH to enhance clinical research so that it is well-positioned to interact efficiently and effectively with the intellectual "homes" at the institutions;

- Leverage alternative stakeholders such as the pharmaceutical and biotechnology industries;
- Address conflict of interest and ethical issues; and
- Address career development issues such as family/career balance and provision of support at each stage of training.

Breakout Session 4

Clinical Research Informatics

Participants in this breakout session oriented their recommendations around the four elements identified by NIH Director Dr. Elias Zerhouni as necessary for enhancing clinical and translational research: 1) facilitating the transformation of clinical and translational sciences into a new academic discipline; 2) promoting the training and career pathways of clinical and translational investigators; 3) enabling more comprehensive integration and expansion of resources for clinical and translational research; and 4) improving intra- and inter-institutional collaborations.

The need to find an academic home for clinical and translational sciences also guided the discussion. Finding this home, participants concluded, would require integrating several different disciplinary "homes," including: methodological fields such as biostatistics, epidemiology, and health services research; clinical research centers, such as the General Clinical Research Centers; health care practice; and biomedical informatics itself, which can help link together all of the other "homes." Because of its role in bridging disciplines, biomedical informatics was identified by participants as an essential part of the new clinical and translational effort, which places a strong emphasis on multidisciplinary collaborations.

Several aspects of biomedical informatics underscore its fundamental importance to new NIH goals for multidisciplinary research and for enhancing clinical and translational sciences. Participants noted that biomedical informatics is integrative, facilitating communication across disciplines and analysis of data from disparate sources.

As a science, informatics continues to generate new knowledge and technologies that are useful to clinical and translational sciences. In addition, biomedical informatics enables high-quality research by providing support for efficient workflows and reductions in redundancy. Current technology can decrease the time spent by investigators and the research team in data collection and analysis and is necessary for more affordable research operations.

With these observations in mind, participants drafted six recommendations by which biomedical informatics could enhance clinical and translational sciences:

- Biomedical informatics should be used to connect individual academic units into a “home” for clinical and translational science;
- Any informatics model used for clinical and translational sciences must possess certain characteristics. First, it must be incremental, meaning that it will be built in stages. Second, the model must be successful at an early stage, allowing for “early wins.” Third, it must be flexible enough to adapt to constant change. Fourth, it should leverage the ongoing efforts in healthcare and research informatics, as well as those in the pharmaceutical industries. Finally, the model should be federated, or distributed, rather than centralized. Institutions should have flexibility in utilizing systems that meet their needs and control over internal processes. However, standards are necessary for robust communication and collaboration between distributed systems encompassing security, messaging, and clinical/translational domain concepts;

- All NIH intramural and extramural programs must adopt the same standards for biomedical informatics related to clinical and translational sciences and be compatible with national standards efforts;
- NIH must provide national leadership to ensure the success of the new informatics model for clinical and translational sciences. As part of this leadership, NIH must provide leadership in promoting inter-institutional collaboration and cooperation, and ensuring that privacy and confidentiality remain high priorities. NIH also must create incentives for various parties to adopt and use data-interchange standards. Incentives must be aligned between institutions, research groups, and investigators so that all parties feel they will benefit from these practices;
- A central resource should be established to provide informatics tools and shared resources for the clinical and translational research community. One model for this central resource might be the National Center for Biotechnology Information of the National Library of Medicine. It should include an open-source type component so that users can share software and standards they develop to enhance tools and resources; and
- Informatics tools must be available for all members of the clinical and translational research community, from collectors of data to specialists who analyze and integrate that data. Some individuals conducting clinical and translational research will need specialized informatics training. Therefore, graduate and doctorate programs should be created to provide that training.

Participants also recommended five actions that institutions should take to further the use of biomedical informatics in clinical and translational research. Institutions should:

- Fashion an institutional strategic informatics vision and an internal process for governing informatics. This vision and governance should integrate research informatics and clinical informatics so that both can use common techniques and approaches;
- Create incentives to promote both intra- and inter-institutional collaboration;
- Establish a robust infrastructure for clinical research informatics. Key components of this infrastructure should include secure electronic transfer of research information (including with clinical care data as needed); electronic submission of necessary regulatory and IRB documents; standards-based support, data collection tools; and mechanisms for more efficient analysis, reporting, and sharing of data;
- Build a strong infrastructure for research informatics that includes tools for data aggregation and visualization. This infrastructure also should include a consultative core, where researchers involved in clinical and translational research could seek help with biomedical informatics; and
- Within the academic home, include an integrated unit for biomedical and clinical research informatics that unites statistics, epidemiology, and health services research to enhance clinical and translational research.

Breakout Session 5

Intra- and Inter-Institutional Collaboration

Participants in this breakout session recognized that effective collaboration and coordination—at institutional, regional and national levels—are critical to enhancing clinical and translational research. Collaboration provides access to a wide variety of complementary skills and resources, thereby allowing investigators to tackle more difficult research questions.

Barriers to greater collaboration include regulations, institutional rules, legal constraints, and competitiveness.

Inter-institutional Collaborations

Participants shared their experiences in overcoming some of these barriers and creating successful inter-institutional collaborations, including clinical trial networks, multicenter trials, and community-based research. Recommendations related to each include:

Clinical trial networks

- Successful models (both NIH and non-NIH) should be shared, to learn how they have dealt with complex issues such as: intellectual property, trademarks, and patents; institutional review board (IRB) activities in multiple institutions; appropriate credit to investigators and faculty at different institutions; and other concerns;

- Models are needed for Measures of Performance (MOPs) and Standard Operating Procedures (SOPs). SOP manuals created with NIH funding at individual institutions should not be considered proprietary, but rather shared with others;
- The need to obtain approvals from multiple IRBs is of particular concern. More uniformity and reciprocity could help streamline what is often a time-consuming process;
- Training in how to set up clinical trial networks is needed; and
- NIH intramural and extramural interactions should be strengthened to facilitate the creation and operation of clinical trial networks.

Multicenter trials

- Training to create and manage multicenter trials is needed. Training should include several unique skill sets, ranging from administration and regulatory affairs to basic science. Few existing training programs incorporate all of these essential skills;
- A career-track model should be created to encourage more investigators to undertake this type of research;
- Training for medical students also is needed, to start them thinking about assuming a role in future clinical trials, whether in research or practice; and
- The issue of professional credit and multiple co-authors is of particular concern for multicenter clinical trials.

Community research

- A community IRB can perhaps complement academic IRB approvals;
- Community participation is needed to help design and carry out the research. Participants cited examples in which issues identified by patients or health care providers resulted in significant research questions being developed (and funded);
- Community doctors and staff can carry out trials with oversight by center coordinators, in a "hub and spoke" model; and
- Strategies are needed to "give back" to a community at the end of the study, rather than use community members as research subjects with no follow-up.

Intra-institutional Collaboration

Some participants suggested that the General Clinical Research Centers (GCRCs) might be expanded to promote intra-institutional collaboration. However, others felt that a more multifaceted program would be necessary, such as a clinical research program that helps clinical scientists to develop strong research applications and that provides biostatistical and other support.

BREAKOUT SESSION CO-CHAIRS

Session 1: Components of a Clinical and Translational Sciences Academic Home
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Paul K. Whelton, M.D., M.Sc., Tulane University Health Sciences Center
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Session 2: Institutional Culture and Commitment for Clinical and Translational Sciences
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Richard Rudick, M.D., Cleveland Clinic Foundation
Judith Swain, M.D., University of California, San Diego

Session 3: Education, Training, and Career Development
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Sherine Gabriel, M.D., Mayo Clinic
Jill Joseph, M.D., Ph.D., Children's National Medical Center
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Session 4: Clinical Research Informatics
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Session 5: Intra- and Inter-Institutional Collaboration
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